rare result, but the chances of which we must not diminish by too heroic treatment.

In a large number of cases, as we have seen, either a foreign body or a perforating ulcer opens the posterior part of the bowel, and the abscess forms in the sub-cæcal tissue. If left to itself, the abscess tends outward, and in a majority of cases recovery ensues. In addition to the simple measures of Dupuytren, we have to give the patient what is called "the supporting treatment." I think it not well to make haste to use the knife. On the other hand, Dr. Buck, who is high authority, says: "The proper treatment, which has been successful in my hands, is this: upon ascertaining the existence of the abscess, I, without waiting for fluctuation to establish itself, make an outlet for the matter below the outer half of Poupart's ligament, and parallel with it, first through the integument, exposing the fascia of the thigh. This fascia being divided, you pass under the ligament, and get behind the iliac fascia. The incision thus made is to be kept open by a plug of lint, renewed every twenty-four hours." This practice, I may be permitted to observe, is not always proper, since a discharge of the abscess through the opening in the bowel is the most favourable termination. Bursting of the abscess into the peritoneum is an accident not to be apprehended in these cases.

ART. IV.—*On the Inhalation of Atomized Medicated Liquids and its Value in the Treatment of Diseases of the Respiratory Organs.* By JOHN HART, M. D., Boston, Mass.

IN the spring of 1865 my attention was attracted by the reports of some cases of diseases of the respiratory organs which had been treated successfully by the new mode of inhaling atomized medicated liquids, and I therefore determined to investigate the subject carefully, and test its value by experience. As a suitable apparatus could not then be obtained, I constructed one myself. After having treated several patients with good results, I exhibited my apparatus at the meeting of the Suffolk District Medical Society, September 30, 1865, and presented the results of this treatment as obtained from the numerous reports of eminent German practitioners. Since then I have resorted to this treatment in a large number of cases with satisfactory results.

Inhalations were recommended in the treatment of diseases of the respiratory organs in the early periods of medical science. Aretæus, Galen, Plinius, Aëtius, Dioscorides, and the Arabians advocated inhalations of vapours and sea-air. Subsequently various gases and vapours, chlorine, iodine, tar, turpentine, etc., were recommended for inhalations; but the efforts which have been made within the last few years to convey remedial agents to the air-passages have been more successful. Medicated liquids have been atomized or converted into such minute particles that they appear in the air like mist or spray, and in this form they are inhaled with the atmosphere.

Mineral waters were first atomized in 1849 by Dr. Auphan, by throwing a stream of water with great force against a wall, and the patients inhaled the minute particles which were thus formed and floated about in the atmosphere of the apartment. The first apparatus, which Flubé and Sales-Girons constructed, was for the purpose of filling a ward with atomized mineral water at Pierrefond, where fifteen patients inhaled at the same time. For the purpose of atomizing other medicated liquids, Sales-Girons had subsequently a portable apparãtus constructed on the same principle as the one used at Pierrefond. To describe the numerous apparatus which have since been constructed would be unprofitable, and I will therefore confine myself to the description of those only which at present are mostly in use.

Sales-Girons' apparatus consists of a strong glass bottle, into the neck of which an air-pump is fastened. The air being condensed at the top of the liquid, the latter is forced through a narrow tube, which has a capillary opening at its free extremity, and is thrown through an aperture in a glass cylinder against a convex lens directly opposite, where it is divided into fine particles. The patient sits before the glass cylinder and inhales these particles, which appear in the form of a fine spray. Mathieu constructed an apparatus which he called Nephogène. It consists of a condenser, where the air is compressed to a certain degree; a valve is then opened, and the air passes through an elastic tube into a glass ball, which contains the medicated fluid, and with this it passes with such force through a minute opening that the stream of water is changed into a cloud of atomized liquid. These two apparatus were much in use until Bergson invented his Hydroconion, and Siegle his Steam-Hydroconion. These are based upon the principle that if two glass tubes with capillary openings at one of their extremities are connected in such a manner that the capillary extremities form a right angle, and that the capillary extremity of the tube which is to convey the medicated fluid is so arranged as to cover about half of the capillary opening of the other tube, and air or steam is forced through the latter, which has a horizontal position, a vacuum will be formed in the other, which has a vertical position, with its lower portion passing into the medicated liquid, the liquid will rise to the top, and there by the force of air or steam be divided into the most minute particles, forming a beautiful spray.

Tubes arranged as here described are generally called Bergson's tubes. Professor Wintrich modified them, dispensed with the connecting medium, turned the capillary extremity of the tube passing into the liquid to a right angle, and bent the tube conveying air or steam in a proper position to the former. Thus the tubes could be made with a free extremity of several inches, be passed into the mouth or other cavity, and the spray be formed there. This modification has lately been adopted for local anæsthesia, by a member of our society, supposing it to be new. The size of the capillary openings and the proper adjustment of the tubes are of the greatest importance in constructing an apparatus. The size of the capillary openings influences the fineness of the spray and the rapidity with which it is formed; the rapidity is also influenced by the greater or less force of the condensed air or steam. Physicians who buy the tubes for their apparatus frequently complain that they either do not work at all, or that one set will atomize an ounce of fluid in five minutes, whilst with another it cannot be done in less than an hour. These uncertainties can be avoided by a careful selection of tubes or by the practitioner making them. This can readily be done by taking a glass tube of about an eighth of an inch diameter, heating this over an alcohol lamp or Bunsen's burner, drawing it out to a fine point, breaking this off at the proper place, and rubbing the point on fine sand-paper or stone until the opening has the desired size. Two such tubes may then be connected and kept in proper position by a wooden or silver clasp, or by a glass rod. In my own practice I use tubes with openings of different sizes. The exact size of the openings of these I am unable to give, but they vary to such an extent that the largest will atomize an ounce of fluid in five or eight minutes, producing a coarse spray, and the smallest in fifteen or twenty minutes, producing a very fine spray, using only a moderate pressure of steam in either. By raising the pressure of steam the spray will be produced more rapidly and thrown with greater force. It is necessary to be able to produce a coarse or fine spray, if we wish to treat successfully the diseases of the different portions of the air-passages.

A little copper boiler, about three inches in diameter and three inches high, with a tube in the top, will generally answer the purposes of a steam boiler. Into the top of the tube a rubber stopper is inserted, through which the glass tube which conveys the steam passes. By proper caution the rubber stopper will never be blown out by the pressure of the steam, but to make it perfectly secure a pin may be passed into the stopper through a small hole in the copper tube. If we wish to apply a cheap safety valve, another glass tube may be passed through the stopper. This tube is closed at its free extremity, and has an opening at the side which is covered by a small piece of rubber tube. By the pressure of steam the rubber will be raised, and the steam have a chance to escape. A stand for the boiler and glass which contains the medicated liquid can easily be made of sheet iron or tin. When the apparatus is to be used, about three ounces of hot water are put into the boiler, and by placing an alcohol lamp or gas burner under it sufficient steam will be made to keep the apparatus in operation.

On using my apparatus, I soon saw that it was important to protect the face of the patient from the spray. I therefore had a glass funnel cut off, so as to leave an opening of three-quarters to one inch diameter, and attached it to a separate stand in such a manner that it could be turned about and also raised or lowered, or moved farther away from the formation of the spray. A tumbler or cup is placed below the funnel to receive the fluid which accumulates on its inner surface. An apparatus like the one described will cost but a trifle, and will answer every purpose as well as those which are more costly. I do not claim any originality or any peculiar advantages for my own apparatus, but the credit of having constructed the first apparatus, and having first brought the subject of inhaling atomized medicated liquids before the profession in Boston.

Do Atomized Liquids penetrate into the Air-passages?—Almost every new theory in science and every step for improvement meet with more or less opposition. Inhalations of atomized medicated liquids have not been exempt from the general rule, and the opponents who were willing to acknowledge the great acquisition which would be gained by the local treatment of diseases of the respiratory organs, denied the possibility of atomized liquids penetrating into the air-passages, and disbelieved the practical value claimed for them. But fortunately numerous experiments, and the success of this new treatment have proved the contrary. In proof of this we refer to a few remarkable facts. Demarquay made numerous experiments upon squirrels, and the inhaled liquids were detected in the air-passages and even in the parenchyma of the lungs. These experiments were repeated by Fieber in Germany with confirmatory results. Demarquay also experimented upon a nurse, who was obliged to breathe through a canula; she inhaled a solution of tannic acid whilst the tracheal opening was closed, and the presence of the acid was proved in the trachea by paper which had been moistened with a solution of chloride of iron and dried again.

I will only call attention to two more and very important cases, which alone ought to suffice to prove the penetration of atomized fluids into the air-passages. One, a case of consumption with severe hemorrhage, was under the care of Dr. Lewin. The hemorrhage was arrested by the inhalation of a solution of sesquichloride of iron. The patient died, and at the autopsy a large cavity was found in the upper lobe of the right lung. It contained shreds and fluid of a blackish colour and some dark-red coagula. The fluid and coagula were analyzed by Dr. Schultz and found to contain iron. The other was a case of Bright's disease under the care of Prof. Zdekauer, of St. Petersburg. The patient had a fearful attack of hemorrhage from the lungs, which was arrested by inhaling a solution of sesquichloride of iron. After two days the patient died. Dr. Holm examined the infiltrated lung-tissue, and detected a much larger quantity of iron than would naturally be present. Were it not that we have sufficient proofs of the penetration of atomized liquids from experiments made directly for that purpose, the clinical results which have been obtained from those inhalations entitle them to be highly valued as a means for the local application of remedial agents to the air-passages, and for the more successful treatment of various diseases of the air-passages.

Temperature of the Spray.—If Bergson's apparatus be used, and the temperature of the room be 19° R., and that of the liquid also 19° R., the temperature of the spray at its point of formation will be 17° R., and at a distance of eight inches 16° R. The higher the temperature of the liquid is, the greater will be the change in the spray. Thus, if the temperature of the liquid be 60° R., the temperature of the spray will be 40° R. at the point of its formation, and it will fall to 17° R. at a distance of eight inches. If the liquid have a temperature of 5° R., the temperature of the spray at its point of formation will be from 9 to 10° R., and at a distance of eight inches about 14° R.

If Siegle's Steam-Hydroconion is used, the temperature of the spray will be much higher than that of the liquid. The nearer to the apparatus the patient inhales, the warmer will be the spray; and the farther, the cooler it will be.

There are but few remedies which are chemically changed by the atomizing process, and as their therapeutic action is not impaired by the change, it will not be necessary to mention them here.

Directions for administering Inhalations of Atomized Liquids.—The patient takes his seat directly in front of the apparatus, which is raised so high that the spray will be on a level with the centre of the open mouth. The patient sits erect, and rests his arms upon the table, or leans against the back of the chair. When the apparatus begins to work, the patient turns his head slightly backwards, and opens the mouth as wide as possible; the spray ought to pass directly through the centre of the open mouth, and the patient is directed to take long and regular inspirations, if the fluid is to penetrate into the minute passages; if it is to be applied to the pharynx, superficial inspirations will be sufficient. During the first sittings, the temperature of the spray may be higher than would be required, because it does not irritate the larynx and excite coughing, if it be warm; the patient's mouth may, therefore, be only four to six inches from the capillary openings, and the distance be gradually increased as circumstances may require. According to the susceptibility of the patient, the first sittings may only be from three to five minutes' duration, and afterwards be prolonged to ten, fifteen, and twenty minutes. Frequent periods of rest must be allowed during the inhalations, because if they are continued without interruption the inspirations become too frequent and superficial. Patients ought to inhale either before or a considerable time after meals, so that the lungs may expand freely. Mental and bodily exercise must be avoided, and if Bergson's apparatus be used, the patient must not keep it in operation himself.

The force and temperature of the spray are to be regulated according to the pathological conditions of the parts. Special rules cannot be given in this regard, and experience will be a better guide. With little practice, patients soon learn to inhale properly and avoid coughing. Persons who are very nervous may inhale only the spray of water at the first sittings, and have the medicine added afterwards.

If patients are left to themselves, they will easily assume a wrong position and inhale carelessly. The apparatus may also become obstructed and not work properly. Physicians who do not devote themselves patiently to this new mode of treatment, and leave remedies for their patients to use themselves, and do not attend to them personally, will never realize the full benefits of this treatment.

After each inhalation, the patient may gargle with pure water, particularly if the remedies act injuriously upon the teeth, or if they are not intended to affect the mucous membrane of the mouth or pharynx. Inhalations must not be administered immediately after bodily or mental exercise, at least not until skin, pulse, and respiration have returned to their normal conditions. Neither is it advisable for patients to go out of doors immediately after an inhalation; they ought to remain in a comfortable room for a quarter of an hour afterwards. Other suggestions might be made, but they will readily occur to the mind of intelligent physicians.

Diseases which have been treated by Inhalations of Atomized Medicated Liquids and the Results which have been obtained.—Inhalations of atomized liquids have been used more extensively in chronic than in acute diseases, not because they are more applicable to the former, but because patients suffering from chronic diseases, particularly such as do not easily yield to remedies, try every variety of treatment from which relief may be expected.

Diseases of the pharynx will generally yield more readily to this treatment than those of the larynx, bronchi, and lungs, probably because the application is more direct. The length of time during which a certain disease has existed cannot serve as a guide for determining the time which will be required for its cure. I have treated patients for certain affections of the air-passages which had existed for five years, and which yielded immediately; whilst others, which had persisted for only two years or less, were refractory, and liable to relapse. Patients always expect miracles from any new treatment, and will easily be discouraged if a favourable result be not immediately obtained. Physicians themselves are also frequently too sanguine in their expectations, and lose confidence in the treatment which is not speedily successful. It must also be remembered, that diseases frequently seem to be aggravated by the first few inhalations, and yet it would be wrong to either abandon the treatment or change the remedies.

Diseases of the Nasal Passages.—To apply remedies to these passages I have constructed an apparatus for the purpose of conveying to them a condensed volume of spray. The face-protector terminates in a tube which can be introduced into one of the passages; during the inhalation the other passages and the mouth are closed, and the whole amount of air is drawn through the tube. Half the quantity of medicated liquid is inhaled through one and the other half through the other passage. The medicine penetrates into the passages, and even to the pharynx, which is proved by the taste and the chemical reaction of the sputa. Nasal catarrh and coryza with copious and putrid secretion have been treated successfully by German practitioners and by myself. In connection with the inhalations, I also frequently use the nasal douche and injections.

Diseases of the Mouth and Pharynx.—In these diseases inhalations of atomized liquids have been used with the most brilliant success. This fact is sufficiently established by the experience of Sales-Girons, Demarquay, Trousseau, Fieber, Waldenburg, Siegle, Lewin, Schnitzler, Vogler, etc., as well as by my own. The affections which have been treated are pharyngitis catarrhalis, granulosa, ulcerosa, crouposa, syphilitica. Sometimes it is necessary to assist the local treatment by constitutional treatment, particularly in syphilitic affections. A more rapid and decided effect is sometimes produced by applying the medicated liquid in the form of a douche, *i. e.*, by throwing a large quantity of coarse spray with considerable force against the mucous membrane of the mouth or pharynx.

Diseases of the Larynx.—Catarrhal laryngitis is treated very successfully with inhalations of atomized liquids, particularly if it be of recent origin. In acute cases, accompanied by pain, difficulty of swallowing, heat and dryness, mucilaginous liquids combined with narcotics are indicated; whilst chronic cases generally demand astringents with or without narcotics.

Tubercular laryngitis, particularly if the lungs are implicated, is more resistant than other diseases. Cases which have existed but a short time sometimes yield to this treatment, but even in such cases relapses must be expected. Though the cases in which a perfect cure can be established are necessarily very rare, most of them can be improved and the distressing symptoms be ameliorated or entirely removed.

Syphilitic laryngitis has been treated successfully by Demarquay, Waldenberg, Schintzler, etc.

Croup and diphtheria have also been treated successfully by Barthez, Fieber, Trousseau, Lewin, Siegle, Biermer, and Schnitzler. Trousseau also mentions two cases of œdema of the glottis which were cured by inhalations of tannin; they were both very severe, and in one tracheotomy seemed to be unavoidable.

Hooping Cough.—Dr. Fieber reports a case where the disease had existed eight weeks without any change. He resorted to inhalations of mistura oleosa and extract of hyoscyamus, and after the seventh day the patient was so well that the treatment was discontinued. Wedeman, Gerhardt, and Siegle also report cases, which were treated with success.

New Formations.—These should only be treated by inhalations when it is impossible or inadmissible to remove them by a surgical operation. Although it can only be expected that by this treatment those of small size can either be removed or arrested, attendant distressing symptoms can frequently be much relieved.

Hoarseness and Loss of Voice.—These are only symptoms of various affections of the larynx, and must be treated accordingly. They are frequently caused by catarrh, inflammation and ulceration, by new formations and also by paralysis of certain muscles. Alterations of the voice may also have a rheumatic origin or be caused by overtaxing the voice, which is frequently the case with preachers, public speakers, and singers. We must not overlook hysterical aphonia, which doubtless depends upon functional derangement of the nervous system.

Dr. Lewin reports a large number of cases which he treated successfully, and he also remarks that the cures were more rapid and the improvement more lasting than if cauterization had been used. I have treated several cases and have found that those depending upon catarrh, inflammation, and even ulceration would rapidly improve. Two cases, which were tubercular, but where the hoarseness had existed but a short time, were soon relieved; whilst another, where the voice had almost entirely been lost for two years, did not improve at all. The lungs were seriously affected in all three.

Diseases of the Bronchi.—Simple bronchial catarrh, not yet become inveterate, is almost invariably cured or improved. Acute bronchial catarrh, accompanied by pain, irritating cough, heat and dryness, and difficult expectoration is treated with the same remedies as acute catarrhal laryngitis; but it is necessary that the inhalations be more frequent and of longer duration, so that a larger quantity of fluid may be inhaled, since a large surface of mucous membrane is generally affected. The inspirations must also be slower and deeper, as it is of the greatest importance to have the medicated fluid penetrate to the minute ramifications of the bronchi. It is necessary also to be cautious in regard to the doses, particularly if astringents are used, which are indicated in chronic cases with profuse secretion. Such cases generally require patience and perseverance; nevertheless, the best results may be expected. Though it is but a few years since this treatment was introduced into Germany, yet numerous cases of long-standing affections of the bronchi are reported to have been treated successfully. I have treated a number of cases of chronic bronchitis, which had resisted the usual methods, and they were in a very short time entirely relieved and no relapses occurred.

Two symptoms, which frequently accompany chronic bronchitis, putrid expectorations and dyspnœa, deserve particular attention. Putrid expectorations can generally be arrested by inhalations of astringents or balsams, and the free exercise of the lungs during inhalations may justly be considered as producing a curative effect upon dyspnœa.

Bronchiectasis.—The existing organic disease cannot be cured, but all the symptoms which accompany it may be relieved. The excessive secretion and cough may be diminished, the putrid odour of the sputa removed, and the dyspnœa much reduced. In some cases it is even possible that the vesicles of a portion of an affected lung may regain some of their former elasticity, and become permeable to air.

In a case which had persisted for several years, and during the last six months the patient had suffered much from profuse secretion, intense cough, and dyspnœa, so that most of the time she could only rest and sleep in a sitting position, was relieved under my treatment. During the first inhalations the expectoration was profuse, but this, as well as the dyspnœa and cough, rapidly decreased, and after a month's treatment the patient was discharged. Four months after discontinuing treatment she still felt perfectly well.

Asthma.—The treatment of this disease varies according to its character. Asthma which depends upon other affections needs different treatment than that which is purely nervous. Inhalations of atomized medicated liquids have been used with great success in either cases. Several patients under my care have been benefited, and one, who had suffered from asthma for several years, and who had had frequent and long attacks, was entirely relieved upon six inhalations, and had no relapse during the five succeeding months, when she removed to another part of the country.

Emphysema.—I cannot speak from experience in regard to this disease, but will give Dr. Wedeman's opinion. He says: "Inhalations of atomized liquids have such a decided influence in bronchiectasis, emphysema, and other asthmatic affections, that they will always be resorted to as soon as their beneficial effects are sufficiently known. In all our cases (at Gerhardt's Clinic), dyspnœa, the most distressing symptom, was removed, the pains in the chest relieved, cough and expectoration diminished, and much relief procured for the patient."

Phthisis.—This disease being of great importance, I intend to make it the subject of a separate paper, and only wish to say here that incipient phthisis can frequently be arrested, and the distressing symptoms of the advanced stages, such as cough, dyspnœa, etc., be much relieved.

Hæmoptysis.—If inhalations of atomized medicated liquids were of no other value than to convey hæmostatics directly to the bleeding air-passages, they would deserve to be highly esteemed by physicians and the community. Not only a dangerous symptom can thus be relieved, but patients are also spared the greatest anxiety and fear of immediate death; and hope for recovery, which nature so lavishly bestows upon consumptives, is rekindled in their bosoms. The numerous favourable reports, which have been published, are from such high authority that no doubt can be entertained in regard to their truthfulness. The results of several cases, which occurred in my own practice, fully confirm the value of each inhalation.

In conclusion, I will give a list of the most important remedies which may be used for inhalations. Any remedy which is soluble can be atomized, but I will mention only those which have been used with benefit either by foreign practitioners or by myself. Exact doses cannot be given, as they vary according to circumstances. Each dose is to be mixed with an ounce of water, and a certain quantity of such a solution is used for an inhalation:—

Tincture of opium, gtt. iij–x.
Acetate of morphia, gr. $\frac{1}{32}$–$\frac{1}{1}$.
Extract of hyoscyamus, gr. $\frac{1}{4}$–jss.
Extract of conium, gr. ss–iij.
Solution of sesquichloride of iron, gtt. j–x.
Tannic acid, gr. ij–vij.
Alum, gr. ij–viij.
Nitrate of silver, gr. ss–x.
Chloride of sodium, gr. j–viij.
Fowler's solution, gtt. j–xx.
Corrosive sublimate, gr. $\frac{1}{16}$–$\frac{1}{4}$.

Various infusions may also be used with advantage in the boiler by which the medicated liquids are combined with medicated steam.

ART. V.—*Hypodermic Injections in the Treatment of Disease.*

By R. B. MAURY, M.D., Port Gibson, Miss.

A REVIEW of this subject in the *American Journal of the Medical Sciences* for April, has suggested the present article. It relates chiefly to the hypodermic use of quinia in malarial fevers, and may be of interest to the profession, as I am not aware that any publication has been made of its use in these diseases by American physicians.

My experiments were made in December, 1864, and January, 1865, while I was a surgeon in the "Confederate Army," in charge of General Hospital, Greenville, Ala., and formed the subject of a report to the Surgeon-General at Richmond. A retained copy of the tabulated statement of cases, which accompanied the report, was lost, so that I am necessarily confined to a statement of general results, and will merely quote from the report such parts as seem desirable.

This report embraces the history of twenty-five cases of malarial fevers, of which six were bilious remittent, five were quotidian intermittent, thirteen were tertian intermittent, and one a case of double tertian intermittent. The instrument used was the ordinary Wood's syringe for hypodermic injections, carefully graduated and found to carry thirty minims.